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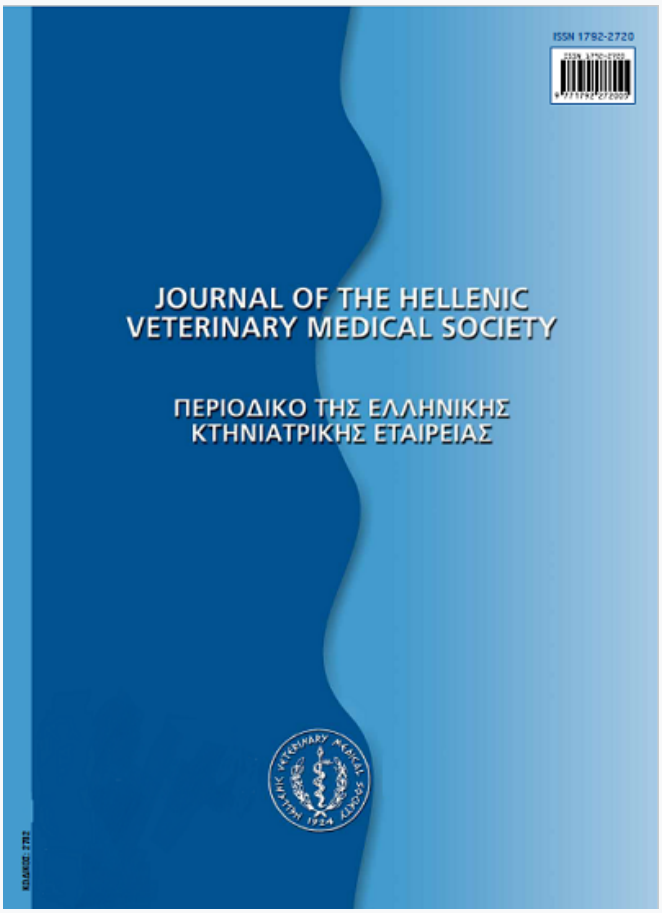
Journal of the Hellenic Veterinary Medical Society

Vol 67, No 4 (2016)



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doi: 10.12681/jhvms.15646

To cite this article:

SKOUFOS, I., TZORA, A., KARAMOUTSIOS, A., TSANGARIS, G., GIANNENAS, I., & FTHENAKIS, G. C. (2018). Milk quality characteristics from Greek indigenous goats. *Journal of the Hellenic Veterinary Medical Society*, *67*(4), 243-252. https://doi.org/10.12681/jhvms.15646

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J HELLENIC VET MED SOC 2016, 67(4): 243-252
ΠΕΚΕ 2016, 67(4): 243-252

Research article
Ερευνητικό άρθρο

Milk quality characteristics from Greek indigenous goats

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Ποιοτικά χαρακτηριστικά του γάλακτος αυτόχθονων ελληνικών φυλών αιγών

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ABSTRACT. The aim of this study was to assess the chemical and microbiological characteristics of goat milk from indigenous Greek breeds, domestic (*Capra prisca*) and Skopelos. Each breed's milk yield was recorded three times during lactation (early, mid and late stage of lactation) for two consecutive years. No significant differences were observed for fat, protein, lactose, casein and solids-non-fat contents of milk from both breeds. The dominant fatty acids (FA) in milk for both breeds were: palmitic (C16:0) and oleic (C18:1). Other abundant FA was stearic (C18:0), myristic (C14:0), capric (C10:0) and lauric (C12:0). The conjugated linoleic acid (CLA) content was similar in both breeds. Linolenic acid content in milk of *Capra prisca* breed was higher than in Skopelos. A high number of minor short chain fatty acids (SCFA), medium chain fatty acids (MCFA) and long chain fatty acids (LCFA) was also observed in milk fat. SCFA's increased in mid lactation in goats of *Capra prisca* breed, while no significant differences were noted during early, mid or late lactation period in medium or long chain FA. In Skopelos breed, SCFA's increased gradually from early to late lactation, while LCFAs followed a descending order. Enumeration of bacteria presented similar numbers of total viable count in milk of both breeds and higher number of Psychrotrophic ones in milk from Skopelos goats to domestic. Somatic cell counts (SCC) values were significant lower in Skopelos breed compared to *Capra prisca.* Caprine milk can be an important source of health promoting substances and deserves further investigation with specific investigation on milk of indigenous local breeds.

Keywords: *dairy goats, fatty acids, indigenous Greek breeds, milk quality*

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Date of initial submission: 30-09-2015
Date of acceptance: 11-10-2015

Ημερομηνία αρχικής υποβολής: 30-09-2015
Ημερομηνία αποδοχής: 11-10-2015

ΠΕΡΙΛΗΨΗ. Στην εργασία αυτή εξετάστηκε η χημική σύσταση και τα μικροβιολογικά χαρακτηριστικά του γίδινου γάλακτος δύο εγχώριων Ελληνικών φυλών, της *Capra prisca* και της Σκοπέλου. Η γαλακτοπαραγωγή κάθε φυλής καταγράφηκε στην αρχική, μέση και τελική φάση της γαλακτοπαραγωγής και για δύο συνεχή έτη. Δεν παρατηρήθηκαν στατιστικά σημαντικές διαφορές μεταξύ των τιμών της πρωτεΐνης, της λακτόζης, της καζεΐνης και των ολικών στερεών συστατικών, ανάμεσα στις δύο φυλές. Το παλμιτικό οξύ (C16:0) και το ολεϊκό οξύ (C18:1) αποτελούν τα σημαντικότερα λιπαρά οξέα στο γίδινο γάλα. Η συγκέντρωση στο γάλα των συζευγμένων λιπαρών οξέων (CLA) μεταξύ των δύο φυλών υπήρξε παρόμοια, ενώ στο περιεχόμενο του γάλακτος της *Capra prisca* το λινολενικό οξύ βρέθηκε σε υψηλότερες συγκεντρώσεις. Καθόλη τη διάρκεια της γαλακτοπαραγωγής δεν υπήρξε σημαντική μεταβολή στα μέσης και μακράς αλύσου λιπαρά οξέα στο γάλα της φυλής *Capra prisca*, ενώ παρατηρήθηκε διακύμανση των τιμών των λιπαρών οξέων της μικράς αλύσου από την αρχή της γαλακτοπαραγωγής προς το μέσον για τη φυλή της Σκοπέλου. Η μέτρηση της ολικής μεσόφιλης χλωρίδας στο γάλα των δύο φυλών δεν έδειξε στατιστικά σημαντικές διαφορές, ο ολικός αριθμός των ψυχρότροφων μετρήθηκε υψηλότερος στο γάλα της φυλής Σκοπέλου, ενώ αντιθέτως ο αριθμός των σωματικών κυττάρων του γάλακτος στη φυλή Σκοπέλου υπήρξε χαμηλότερος αυτού της *Capra prisca*. Αποτελεί δεδομένο ότι το γίδινο γάλα μπορεί να αποτελέσει τροφή με ευεργετικές δράσεις για την υγεία του ανθρώπου και ως εκ τούτου η διερεύνηση των συστατικών του γάλακτος των αυτόχθονων Ελληνικών φυλών μπορεί να παίξει σημαντικό ρόλο για τις ιδιότητες και τα χαρακτηριστικά του.

Λέξεις ευρετηρίασης: *γίδινο γάλα, λιπαρά οξέα, φυλή Capra prisca, φυλή Σκοπέλου, ποιοτικά χαρακτηριστικά γάλακτος*

INTRODUCTION

The global goat milk production has reached 17.9 million tonnes in 2013, with Europe producing 2.5 million (FAOSTAT, 2013) and at the same time being the unique continent where goat's milk production has significant economic importance. In Mediterranean countries, Greece ranks 1st in goat population with 4.25 millions, however due to low animal milk yield the total goat milk productivity is 340 thousand tonnes and ranks 3rd after France and Spain, with goat milk production of 580.7 thousand tonnes and 471.9 thousand tonnes, respectively (FAOSTAT, 2013). The goat milk production represents almost 18.3% of the total milk production of the country (with cow fresh milk of 805, sheep fresh milk of 705 and buffalo milk of 0.16 thousand tonnes respectively).

In southern Europe, Greece, France, Spain, Italy and Portugal retain a strong specialization for milk production, being the main producers' ca. 80% of the goat milk in the EU (FAOSTAT, 2013). Greece has a long tradition for raising goats and a proportion of more than 85% of goat population belongs to the Greek native breeds *Capra prisca* (>80%) and Skopelos (<2%) and they are well adapted to local environmental conditions and the traditional agricultural systems (Simos et al., 1991). However, research data regarding performance and production characteristics of these breeds are rather scarce.

In Greece, goat milk is mainly used for manufacturing traditional goat cheese (100% goat milk), feta cheese mixed with goat milk up to 30% and sheep milk (>70%) and kaseri cheese mixed with goat milk up to 20% and sheep milk (>80%). Moreover, nowadays there is an increasing tense for consumption of fresh pasteurized goat milk. Therefore, consumers' demand for products of goat milk has been increased today (Utami, 2014) following a rising tendency for the last two decades (Haenlein, 1996) due to beneficial effects on human health (Haenlein, 2004; Thohari et al., 2012; Zhang et al., 2015). This demand is also growing because of a wider awareness of consumers about the affliction of people to cow milk allergies and other gastrointestinal ailments (Park, 1994; Ribeiro and Ribeiro, 2010).

The nutritional quality of goat dairy products is highly correlated with milk fat quality and its high concentration of n-3 fatty acids, as well as high content of CLA. Moreover, milk fat influences processing of raw material and is a carrier of taste and aroma (Morand-Fehr, 2005). Goat milk from indigenous Greek breeds has not been evaluated on the basis of beneficial effects on human health, which is necessary in order to further promote goat farming. Dairy goat traditional or innovative products may stand as an effective tool for regional and national socio-economic development.

The aim of this study was to determine certain quality characteristics of milk from indigenous Greek dairy goat breeds. The chemical composition, somatic cell counts (SCC), fatty acid composition and the microbial flora, throughout the lactation period were assessed for two consecutive years.

MATERIALS AND METHODS

1.Animals and Sampling

The present study was conducted during March-August 2013 and 2014 in mainland Greece. It involved 5 flocks of *Capra prisca* breed and 4 flocks of Skopelos breed. Bulk and individual milk samples were obtained from goats every second month, three times during the lactation period for two consecutive years. The goats belonging to *Capra prisca* and Skopelos breeds were raised under the traditional semi-extensive system with a lactation period of nine months. The goats were hand milked twice a day, in the morning and the evening.

A total of 108 raw bulk milk samples were collected directly in sterile bottles and were transferred to the laboratory for further analysis. Samples were analysed for chemical and fatty acids composition, total bacterial count as well as number of *Enterobacteriaceae* and phychrotrophic microorganisms. Additionally, individual milk samples of 10-15 ml were obtained into a sterile container and were examined for pathogenic bacteria. Each sample was obtained from both mammary glands of individual goats that were selected randomly from the animals of each flock. The number of goats selected, represented the 5% of the animal population of the aforementioned flocks according to the methodology described by Fthenakis (1994). Those individual samples were also subjected to California Mastitis Test (CMT) and SCC using the method described by Fthenakis (1995) and Berry and Broughan (2007), respectively.

2. Milk Production, chemical composition of milk and fatty acids profile

The milk yield of each goat breed was recorded at the three stages of lactation (early, mid, late) for two consecutive years. Milk samples were analysed for fat, protein, lactose and total solids using infrared methodology MilkoScan 4000 (FOSS Electric, Integrated Milk Testing™, Denmark). Milk acidity was measured by a portable pH meter BT-600 (BOECO, Germany).

For the analysis of fatty acids profile, refrigerated raw milk samples (250 ml) were left at room temperature of about 20°C for 20 min. Each sample was, then filtered, and centrifuged (Beckman J2 MC; Beckman Instruments, Fullerton, CA) at 6000 g for 30 min at 20°C. The tubes containing the centrifuged milk were placed on ice until the milk fat was solid. Thereafter, the solid fat was removed and treated with anhydrous sodium sulfate. The mixture was extracted four times with diethyl ether and the total organic fraction was filtered, exposed to a stream of N_2, and dried by evaporation under low pressure at 4°C. The extracted fat residue was stored frozen at –20°C until analysis. For preparation of fatty acid methyl esters (FAME) of milk fat, 0.1 g of fat was dissolved in 1 ml of hexane, and 0.05 ml of 2*N* potassium hydroxide in methanol was added as described by Christopherson and Glass (1969). Apparatus used: Obtained samples were analysed by a gas chromatographer Agilent 7890A system (Agilent Technologies, Santa Clara, CA, USA) with flame ionization detector (GC-FID), auto-injection module for liquid, equipped with SP 2560 capillary GC column (100m x 0,25 mm). Carrier gas was helium (purity > 99.9997 vol %, flow rate = 1.26 ml / min, produced by Messer, Germany). The FAs peaks were identified by comparison of retention times with retention times of standards from Supelco 37 component FA methyl ester mix and with data from internal data library, based on previous experiments and FA methyl ester determination on GC-MS. Results were expressed as mass of single FA or FA group (g) in 100 g of total FAs (relative content).

3. Microbiological evaluation

Milk samples that were obtained from both the milk tank and individually at the 5% of female animals in each farm were subjected to microbiological analysis. The prevalence of bacterial pathogens in individual samples was assessed in order to estimate the hygienic status of the udder of goats in each flock. For this purpose Total Viable Count (TVC) and *Enterobacteriaceae* counts were determined by the TEMPO method (Crowley et al., 2009; Owen et al., 2010). The TEMPO® system (bioMerieux, France) is a semi-automated analyser based on Most Probable Number (MPN) where the microbial growth is indicated by an increase/or decrease in fluorescence. Total aerobic bacteria and *Enterobacteriaceae* counts were determined by TEMPO® TVC and TEMPO® EB kits (both purchased from bioMerieux, France) respectively, according to the manufacturer's instructions. Serial decimal dilutions of milk samples in Ringer's solution up to 10^{-4} were performed and cultures were prepared on plate count agar for enumeration of total Psychrotrophic bacteria as described by standard methods of the American Public Health Association (Wehr

et al., 2012). The incubation conditions were kept at a constant temperature of 6.5 ± 0.5˚C for 10 days (Downes, 2001). For the isolation of pathogenic bacteria, 10 μl from the secretion samples were plated onto Columbia 5% sheep blood agar and were incubated aerobically at 37˚C for up to 72 h. The isolated bacteria were identified by using conventional microbiological techniques (Barrow and Feltham, 1993).

4. Statistical analysis

Data on milk production and composition were analysed as repeated measurements by ANOVA in the General Linear Model of the SPSS v.20.00, statistical package (SPSS Inc., Chicago, USA). Data on fatty acids, bacterial counts and SCC were analysed by one way ANOVA; as for above, breed was considered to be the statistical unit. The homogeneity of the variances was tested by Levene's test. The Tukey's multiple comparison test was carried out to assess any significant differences at a probability level of $P<0.05$ between the experimental groups, when a significant effect of treatment was detected by the ANOVA.

RESULTS AND DISCUSSION

The overall aim of this work was to obtain information on the variation of chemical composition and the fatty acids composition of milk from two indigenous Greek dairy breeds of goats throughout lactation as well as to assess the microbiological quality of milk. Although, there are some studies concerning some components of goat milk from the native Greek breed *Capra prisca*, such as vitamin and mineral content (Kondyli et al., 2007; Kondyli et al., 2012), the information on chemical quality and its seasonal variation is deficient. On the other hand data on chemical quality characteristics of Skopelos breed are extremely scarce. Moreover, to our knowledge data on microbiological quality of milk of goats of Greek breeds throughout the lactation period are not available in existing literature.

Table 1 shows mean average milk yield between the two breeds. The result showed that milk yield was significantly higher in Skopelos breed compared to *Capra prisca*. However, no significant differences were noted regarding chemical composition of milk between the two breeds.

Tables 2 and 3 show the seasonal changes of milk composition during the lactation period. It is interesting that despite the seasonal tendency for fat content increase and lactose content decrease, no significant changes were found which is most likely related to the lower milk yield obtained as lactation was progressing.

Table 4 shows the fatty acid composition of milk of the two goat breeds. The dominant FAs in milk from both breeds were palmitic (C16:0) and oleic (C18:1). Other abundant FA was stearic (C18:0), myristic (C14:0), capric (C10:0) and lauric (C12:0). These FA accounted for about 80% of total FA in goat milk of both breeds. The contents of FA in goat milk did not differ significantly between the two breeds. Our results in *Capra prisca* breed are in accordance to values found by Kondyli et al. (2012); however no data concerning the FA profile of Skopelos breed were found in the literature.

Figure 1 shows that SCFA are increased in mid lactation in *Capra prisca*, while no significant differences

Table 1. Mean chemical composition of caprine milk of two Greek breeds

	Capra prisca (n=60)	*Skopelos* (n=48)
Milk, g/d	711.1[b]	926.5[a]
pH	6.75±0.12	6.83±0.19
Fat (g/kg)	43.19±14.56	47.45±15.92
Protein (g/kg)	37.56±6.18	37.22±4.53
Lactose (g/kg)	42.53±4.64	42.83±4.14
Total solids (g/kg)	131.95±16.10	135.83±17.04

[a,b]: values in the same row with different superscript differ significantly at p<0.05

Table 2. Seasonal variation of milk of Capra prisca goats

	(n=20)	(n=20)	(n=20)
pH	6.74±0.14	6.73±0.10	6.79±0.11
Fat (g/kg)	41.23±16.04	44.66±13.78	44.68±12.51
Protein (g/kg)	37.06±7.13	38.03±6.11	37.81±4.34
Lactose (g/kg)	44.44±4.93	42.28±3.62	39.74±3.64
Total solids (g/kg)	131.29±17.53	133.53±15.38	131.21±14.38

Table 3. Seasonal variation of milk of *Skopelos* goats

	Early (n=16)	Mid (n=16)	Late (n=16)
pH	6.81±0.17	6.85±0.15	6.84±0.24
Fat (g/kg)	45.19±17.34	49.19±17.73	48.05±11.16
Protein (g/kg)	37.13±5.26	37.17±3.78	27.36±4.48
Lactose (g/kg)	46.14±3.66	41.63±2.87	40.36±3.40
Total solids (g/kg)	136.53±18.51	136.30±18.34	134.45±13.47

are noted during early, mid or late lactation period in medium or long chain FA. In Skopelos breed (Figure 2), SCFA and MCFA have been increased gradually from early to late lactation, while LCFA are following a descending order. The CLA content of milk was similar in both breeds. The CLA (cis-9, trans-11) is the most biologically active isomer which accounts for over 80% of the isomers of CLA in milk fat. The content of linolenic acid in milk of *Capra prisca* breed was higher than that of Skopelos breed.

In the current study the mean total TVC for bulk-tank goat's milk was determined at 1.2 x 10^7 cfu / ml and 3.2 x 10^7 cfu / ml for *Capra prisca* and Skopelos breeds respectively, with a minimum of 10^3 for both breeds and a maximum 4.4 x 10^7 cfu / ml and 2.5 x 10^8 cfu / ml, according to the aforementioned correspondence to breeds. Enumeration of bacteria (5) showed higher number of Psychrotrophic bacteria in Skopelos breed compared to *Capra prisca.* Table 5 shows that Psychrotrophic bacteria ranged from 10^2 – 10^6 cfu / ml for both breeds bulk-tank samples.

In mammary secretion samples from individual goats, higher microbial quality raises the point in which deterioration of milk quality starts. *Staphylococcus aureus* was not detected in all tested mammary secretion samples. The prevalence of Coagulase Negative Staphylococci (CNS) was detected at a rate of 48 – 50% and appeared as the prominent pathogenic group in our findings for both goat breeds (Table 6).

In our results, CMT scores were 0 – 1 and the SCC ranged from 343 x 10^3 to 780 x 10^3 cells / ml for Skopelos and *Capra prisca* breeds respectively (Table 7). SCC values were significant lower in Skopelos breed compared to *Capra prisca* (Table 7).

The proportion of goat milk processed into cheese is much higher in comparison to cow milk. The quality

Table 4. Fatty acid composition of caprine milk of two Greek breeds[1]

Fatty acids (g 100g^{-1})	*Capra prisca* (n=30)	*Skopelos* (n=24)
C4:0; butyric	1.47±0.72	1.05±0.60
C6:0; caproic	2.85±1.12	2.49±2.05
C8:0; caprylic	3.22±1.15	2.75±1.16
C10:0; capric	9.96±3.55	8.67±3.09
C11:0; undecylic	0.22±0.11	0.25±0.18
C12:0; lauric	4.66±2.25	3.72±1.39
C14:0; myristic	9.81±1.64	8.94±1.63
C14:1; myristoleic	0.41±0.13	0.33±0.10
C15:0; pentadecylic	1.09±0.33	1.06±0.40
C16:0; palmitic	26.95±2.65	26.48±3.81
C16:1; palmitoleic	0.61±0.22	0.70±0.38
C17:0; margaric	0.66±0.21	0.61±0.23
C18:0; stearic	14.15±3.94	14.49±4.35
C18:1n9t; elaidic	1.46±0.71	1.25±0.46
C18:1n9c; oleic	19.11±4.34	22.08±6.21
C18:2t; conjugated linoleic acid	0.25±0.13	0.24±0.09
C18:2n6c; linoleic	1.96±0.61	2.21±0.90
C20:0; arachidic	0.13±0.06	0.16±0.06
C18:3n6; γ-Linolenic	0.98±0.31	0.85±0.41
C20:1; cis-11-Eicosenoic acid	0.16±0.05	0.18±0.13
C18:3n3;linolenic acid	0.55±0.31	0.46±0.23

Table 5. Enumeration of different microbiological parameters detected in raw goat's milk

	Capra prisca			*Skopelos*		
(cfu / ml)	Min	Max	Average±SD	Min	Max	Average±SD
TVC#	$2.0x10^3$	$4.4x10^7$	$1.2x10^7 \pm 1.9x10^6$	$6.5x10^3$	$2.5x10^8$	$3.1x10^7 \pm 7.4x10^7$
EB!!	$2.6x10^1$	$1.5x10^7$	$2.6x10^6 \pm 5.3x10^5$	$8.8x10^2$	$3.0x10^7$	$5.4x10^6 \pm 1.0x10^7$
PS++	$8.4x10^2$	$3.5x10^6$	$5.5x10^5 \pm 1.2x10^{5b}$	$4.5x10^2$	$2.5x10^7$	$5.6x10^6 \pm 9.4x10^{5a}$

#: Total Viable Count, !!: Enterobacteria, ++: Psychrotrophic

[a,b]: values in the same row with different superscript differ significantly a $p<0.05$

of this milk can be evaluated by various criteria: sanitary, dietetic, nutritional, content of compounds with health promoting properties (Morand-Fehr et al., 2007).

An almost overlooked component in goat milk is its fat or lipid content. Average goat milk fat differs in contents of its fatty acids significantly from average cow milk fat (Jenness, 1980), being much higher in butyric (C4:0), caproic (C6:0), caprylic (C8:0), capric (C10:0), lauric (C12:0), myristic (C14:0), palmitic (C16:0), linoleic (C18:2), but lower in stearic (C18:0), and oleic acid (C18:1). Three of the MCT (C6–C14) have actually been named after goats, because of their predominance in goat milk. Caproic, capric and caprylic acids have become established medical treatments for an array of clinical disorders (Schwabe et al., 1964; Greenberger and Skillman, 1969; Kalser, 1971; Tantibhedhyangkul and Hashim, 1975; Alférez et al., 2001). Goat milk exceeds cow milk in monounsaturated (MUFA), polyunsaturated fatty acids (PUFA), and medium chain FA, which all are known as beneficial to human health, especially for cardiovascular conditions. In our work, both breeds presented these 3 MCFA at the level of 15% of their FA content. This biomedical superiority has not been promoted much in marketing goat milk, goat yoghurt and goat cheeses, but has great potential in justifying the uniqueness of goat milk in human nutrition and medicine (Babayan, 1981; Haenlein, 1992) for treating the various gastro-intestinal disorders and diseases, besides its value in alleviating cow milk allergies (Haenlein, 2004).

The mean TVC values and populations of *Enterobacteriaceae* were similar to levels reported for Greece and Portugal goat's bulk milk (Morgan et al., 2003) and into the fluctuated limits for Switzerland (Muehlherr et al., 2003). These bacteria loads were higher of the respective limits determined in US and Italy (Foschino et al., 2002). Mean values for samples collected from some farms exceeded the maximum limit of EU regulations (EU, 2004), for milk originating from small ruminants, while others had values significantly lower from EU regulation's limit (table 5). Bramley (1990) reported that the number of psychrotrophs should represent about 10 – 50% of total bacterial count which is in agreement with our results. In general, deteriorated microbial quality of bulk-tank raw goat's milk could be related to factors such as inferior hygienic condition of milk production, and/or bad handling and collection procedures (Anifantakis, 1993). The significant differentiation between values of all bacterial groups in our findings may indicate the sample origin as the main factor affecting the microbial composition of the goat's milk. In fact sample quality is affected by a multitude of different elements, such as the type of the breeding system, hygienic conditions of milking, breeders' practices and location of the farm. The superiority in goat's milk microbial quality in France may be attributed to the application of intensive breeding systems (Morgan et al., 2003). Similar differences may be attributed either to the absence of teat washing or in general, to insufficient hygienic practices before milking (Fthenakis et al., 2012).

According to Vanderhaeghen et al. (2015) milk with low SCC content and a low total bacteria count is an indication of healthy animals and a good hygienic standard at the farm. Several studies have shown CNS as the main etiological agent of small ruminant intra-

Table 6. Percentage of detected pathogenic bacteria in raw goat's milk

	Capra prisca			*Skopelos*		
of positive samples	Bacterial strains	No of samples	Positive samples %	Bacterial strains	No of samples	Positive samples %
Staph. aureus	12	ND[d]	0	25	ND	0
CNS[e]	12	6	50	25	12	48
Enterobacteriaceae	12	4	33.3	25	9	36
E.coli	12	ND	0	25	1	4
Streptococcus spp	12	ND	0	25	1	4

d: Not detected, e: Coagulase negative staphylococci

mammary infections, correlated positively with the increase of SCC values (Leitner et al., 2011). Positive correlation of high bacterial load from the mammary secretion was found with SCC and CMT. The reported values for SCC in goat milk vary and are usually between 2 and 10 x 10^5 / ml milk (Paape et al., 2007; Goetsch et al., 2011). The SCC in goat milk typically increases towards the end of lactation and with subsequent lactations. Furthermore, milk SCC in small ruminants are influenced by non-infectious factors such as lactation stage and parity. However, mastitis is the main factor that leads to an increase in SCC due to response to infection in small ruminants (Fthenakis, 1994; Kiossis et al., 2012; Petridis et al., 2012). The main etiological agent of mastitis in small ruminants is CNS, and special attention should be paid to this group of bacteria (Souza et al., 2012). The milk SCC from healthy goats ranges from 270 – 2,000 x 10^3 cells/ml (Tian et al., 2005).

de Crémoux et al. (1996) set a threshold of 750 x 10^3 cells / ml for predicting the presence of minor pathogens and a threshold of 1750 x 10^3 cells / ml for major pathogens in goats. However, Persson and Olofsson (2011) proposed a threshold of 345 x 10^3 cells / ml to differentiate between infected and non-infected glands and goats.

In goats most studies have proposed a score of 2 in CMT as the threshold for the detection of the infected glands (Contreras et al., 1996; Persson and Olofsson, 2011). The findings of CMT and SCC were into "healthy,, limits despite the prevalence of CNS. Differentiation in values of SCC between the two breeds could be explained due to breed origin. Similar differences have been observed between Toggenburg and Oberhasli breeds in US (Paape et al., 2007).

The CNS group is associated with subclinical mastitis in ruminants with significant economic importance (Huijps et al., 2008). CNS have been recognized as an heterogenous group of microorganisms and increased attention will be given to dairy flocks with frequent intramammary infections (Tzora et al., 2014; Vanderhaeghen et al., 2015). However, the pathogenic role of CNS is complex and some CNS species / strains might have a beneficial effect on udder health (Vanderhaeghen et al., 2014). Therefore, improving hygienic conditions during milking is an essential step towards limiting microbiological hazards (Lodi et al., 1994).

The composition of raw bulk milk is of prime importance for the manufacture of dairy products. In both Greek breeds, despite the tendency for fat increase and lactose decrease, chemical quality of milk was not considerably affected during progress of lactation. According to chemical values, milk from both Greek

Table 7. Enumeration of somatic cells in raw goat's milk

	Capra prisca	*Skopelos*
CMT	0 – 1	0 – 1
SSC (cells / μl)	779.85 ± 87.22 [a]	343 ± 88.79 [b]

[a,b]: values in the same row with different superscript differ significantly a $p<0.05$

breeds is of excellent quality during the whole lactation period. However, microbial load of milk is considered as rather high and further improvement in both milk yield and microbiological status may be of critical importance for future goat breeding in both breeds.

ACKNOWLEDGMENTS

This research has been co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: **ARCHIMEDES III**.

CONFLICT OF INTEREST STATEMENT

None of the authors have any conflicts of interest to declare.

Figure 1. Seasonal variation of fatty acids in milk of *Capra prisca* breed

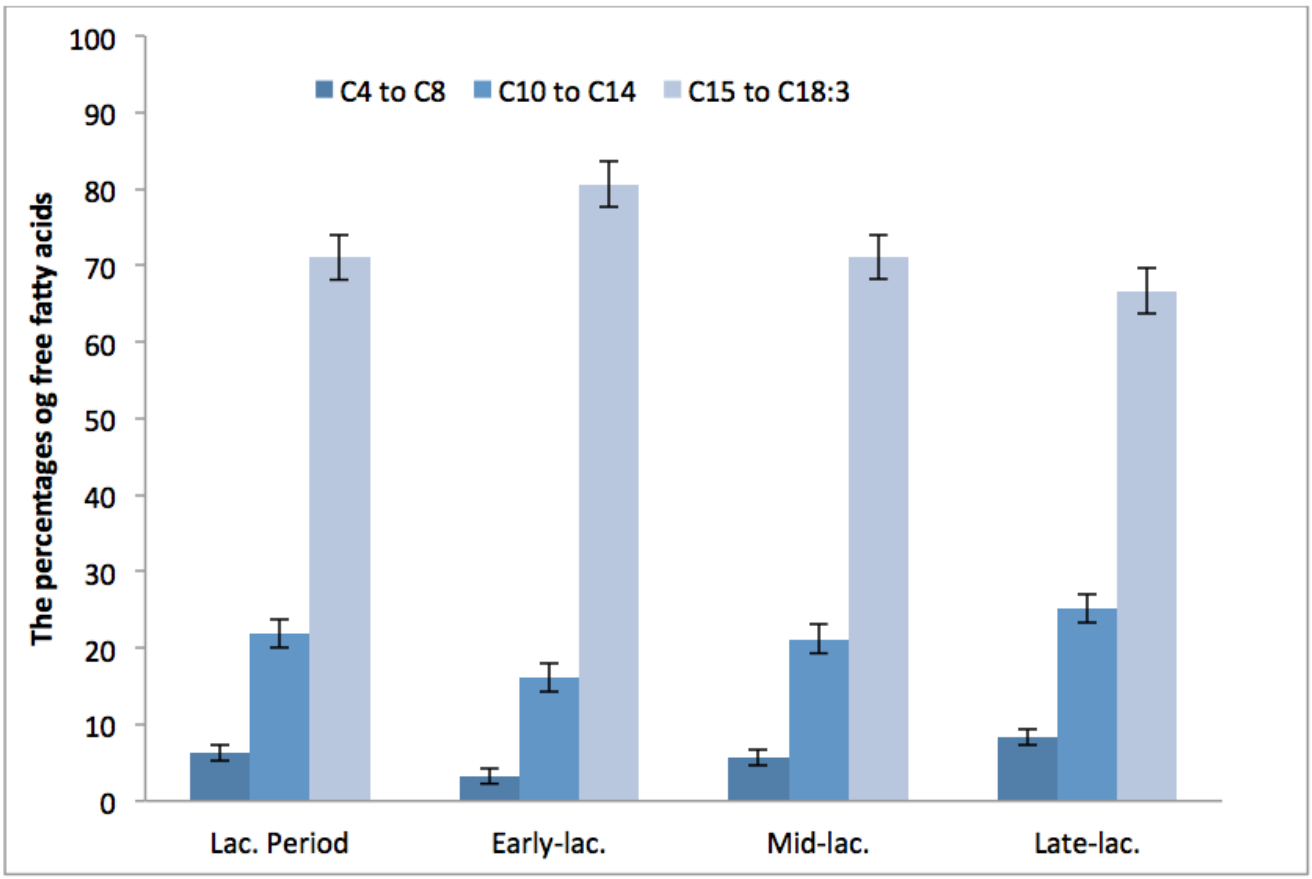
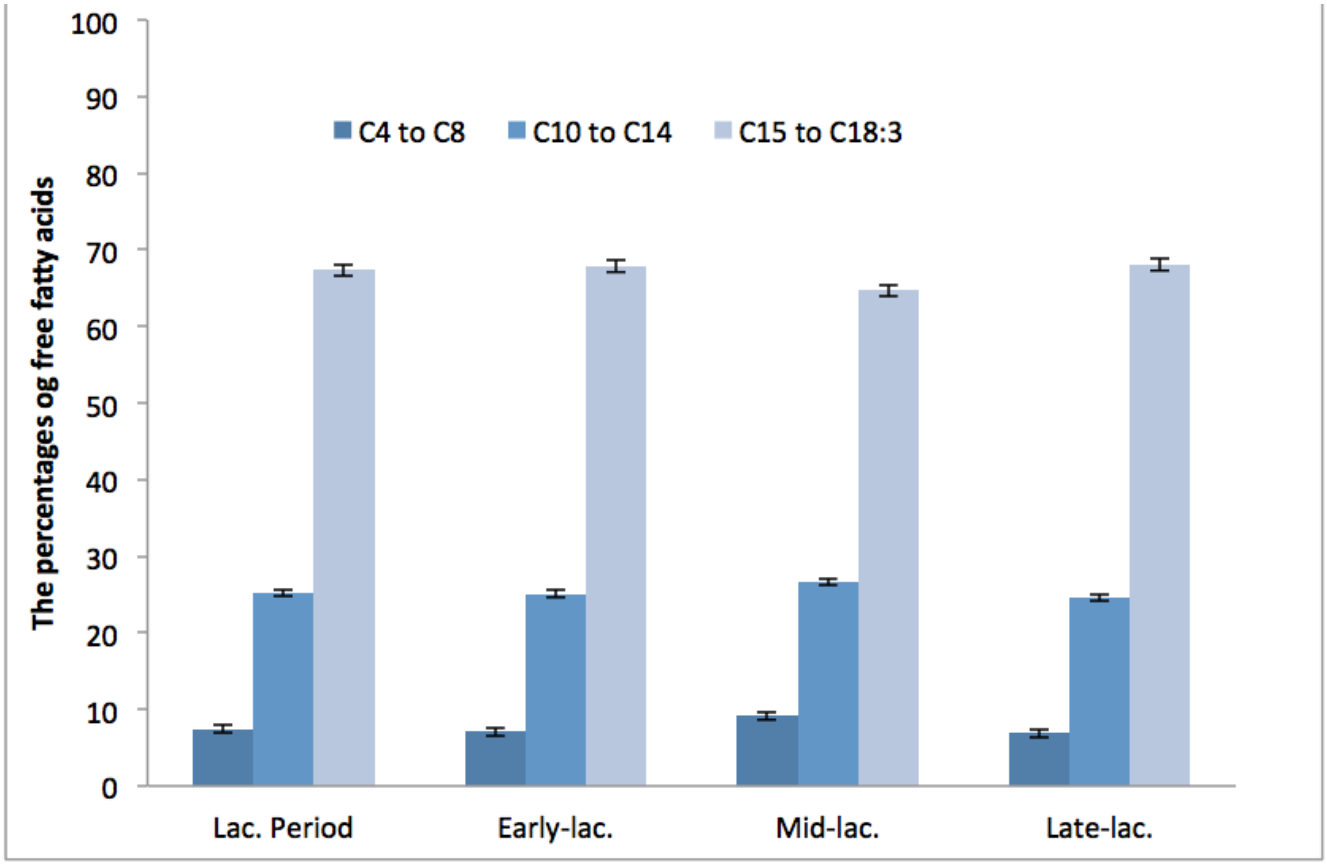


Figure 2. Seasonal variation of fatty acids in milk of *Skopelos* breed



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